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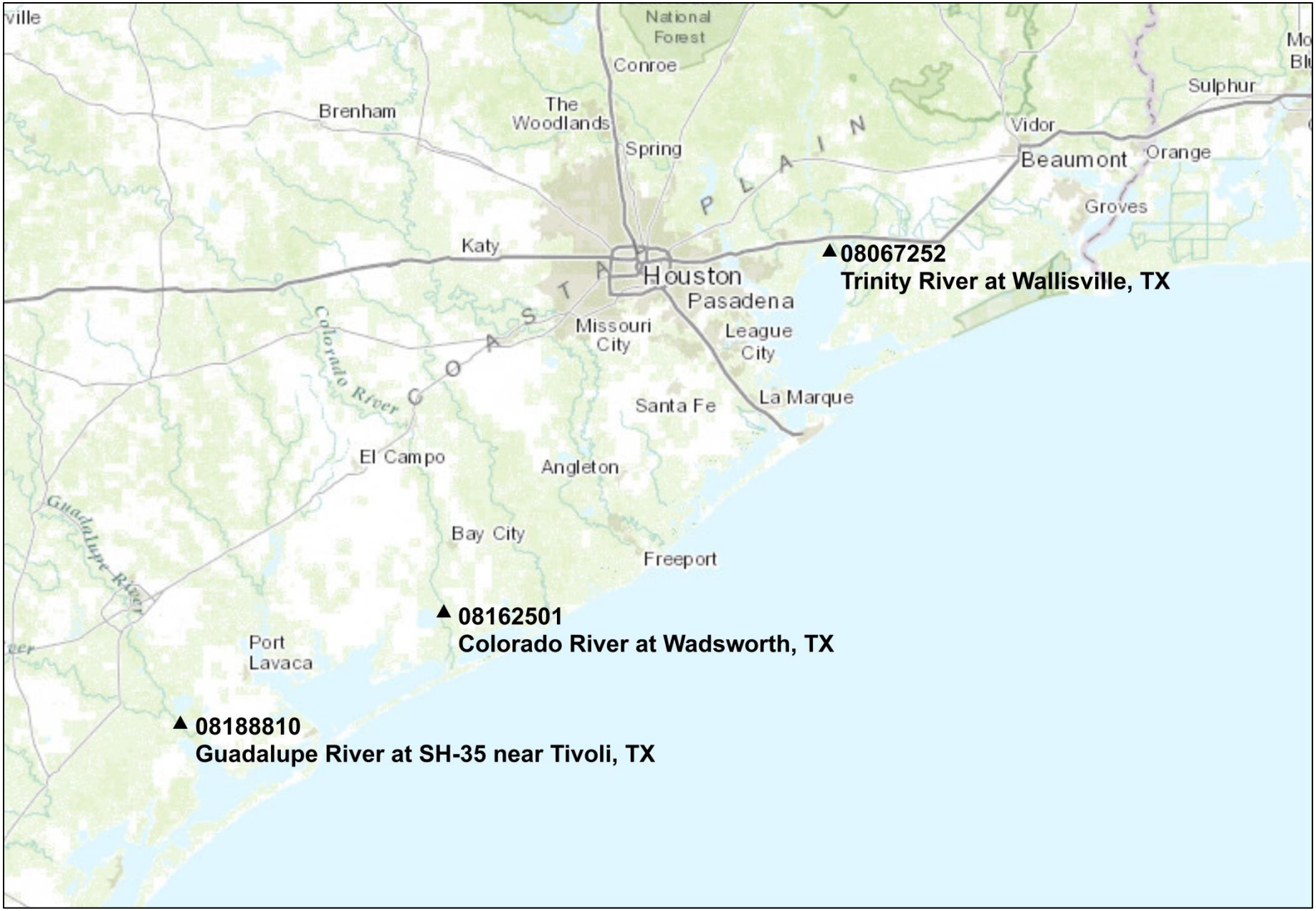
USGS Monitoring of Freshwater Inflows to Texas Bays and Estuaries

October 27, 2015

U.S. Geological Survey
Texas Water Science Center
Gulf Coast Program Office


National Forest
Conroe
The Woodlands
Brenham
Spring
Vidor
Sulphur
Beaumont
Orange
Groves
COASTAL PLAIN
Katy
Houston
Pasadena
Missouri City
League City
La Marque
Santa Fe
Colorado River
El Campo
Angleton
Bay City
Freeport
Guadalupe River
Port Lavaca
▲08067252
Trinity River at Wallisville, TX
▲08162501
Colorado River at Wadsworth, TX
▲08188810
Guadalupe River at SH-35 near Tivoli, TX

OBJECTIVES

- Define flow patterns in the lower reaches freshwater inflow rivers.
- Evaluate the variability of nutrient and sediment concentrations and loads entering Texas bays and estuaries over a range of hydrologic conditions.
- Define correlations between in situ field measurements and discrete nutrient and sediment concentrations.

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Water Quality Monitoring

- Physical Water Properties
  - Temperature
  - pH
  - Specific Conductance
  - Dissolved Oxygen
  - Turbidity

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Water Quality Monitoring

- Suspended Sediment Concentration
- Bed material
- Nutrients
  - Total N and P
  - Ammonia
  - Nitrate + Nitrite
  - Orthophosphate
- Discharge

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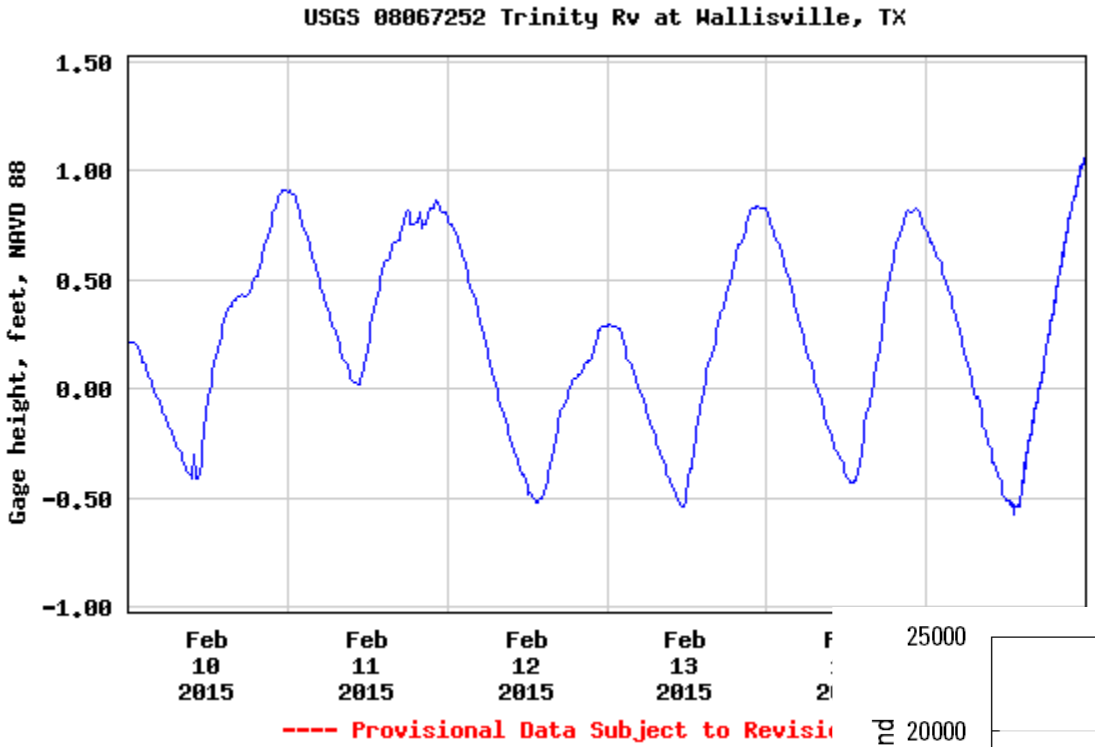
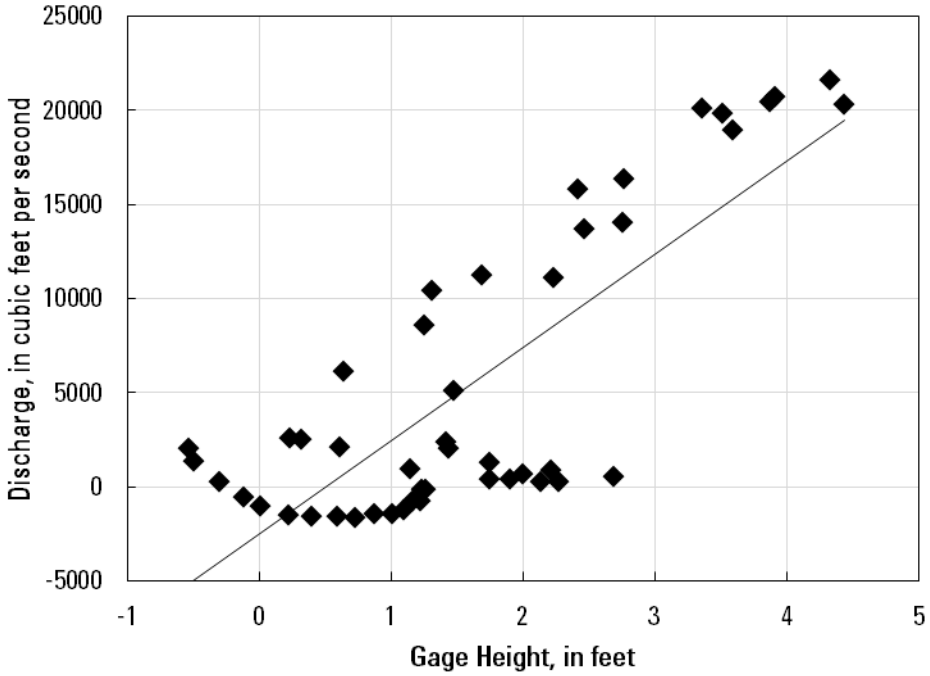
INDEX-VELOCITY GAGE



- Coastal sites:
  - Multiple discharge for same stage



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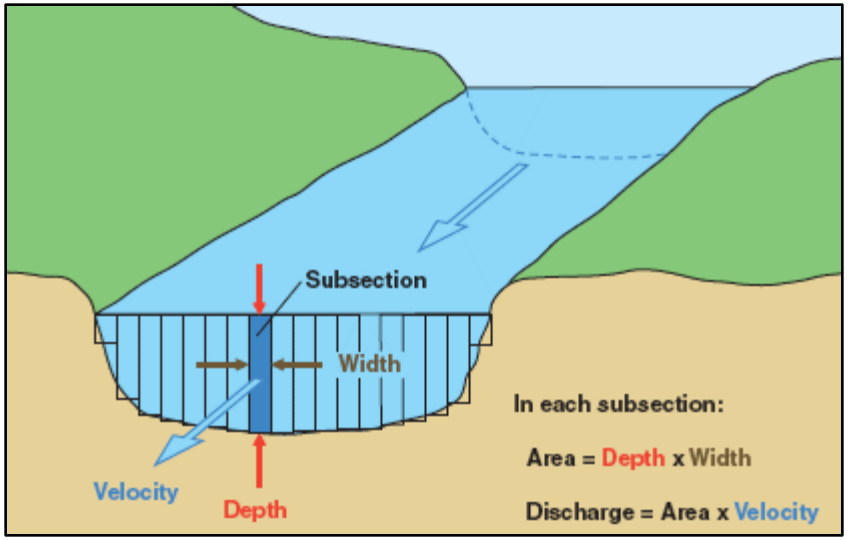
INDEX-VELOCITY METHOD

$$Q = \text{Area} \times \text{Velocity}$$



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Acoustic Backscatter

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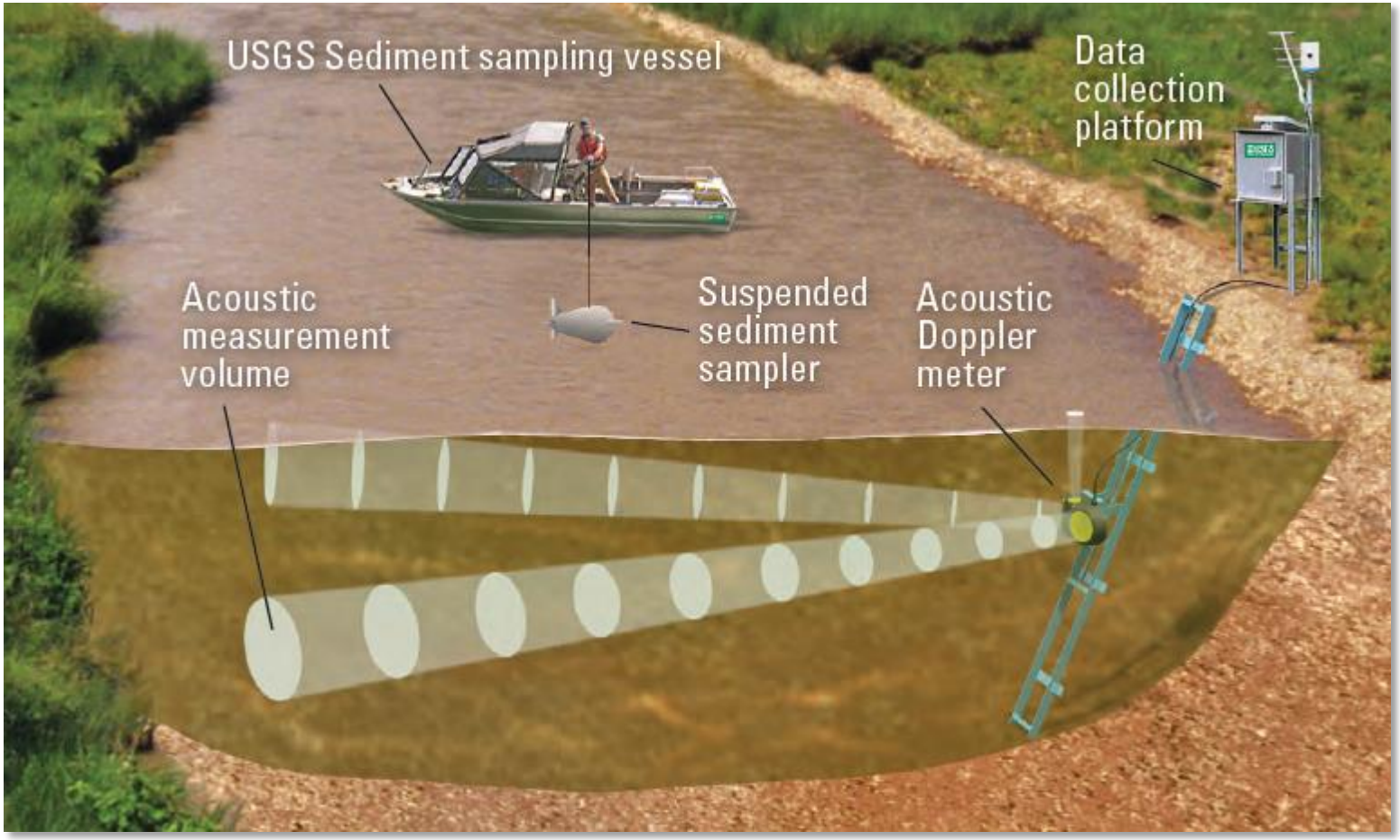
Acoustic Surrogate Development



Wood, M.S., 2014, Estimating suspended sediment in rivers using acoustic Doppler meters: U.S. Geological Survey Fact Sheet 2014-3038

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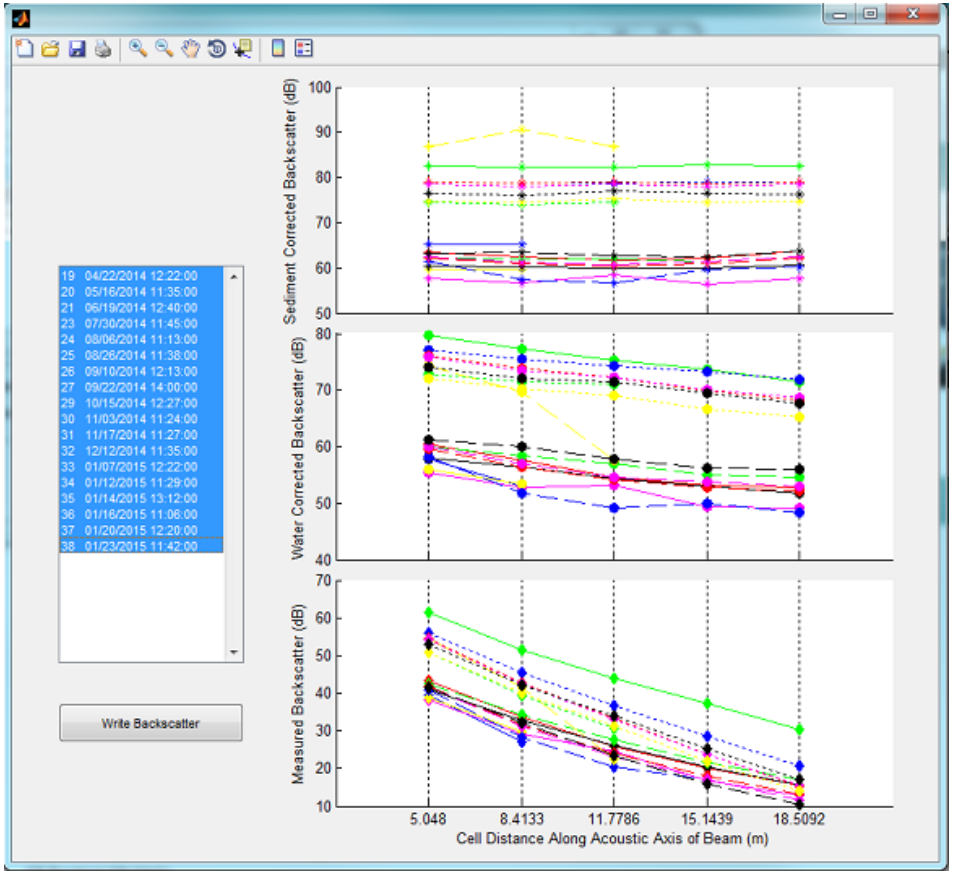
Data Processing

- USGS SAID tool to process backscatter data
- Measured backscatter needs to be corrected for:
  - Beam spreading and adsorption by water
  - Attenuation by sediment



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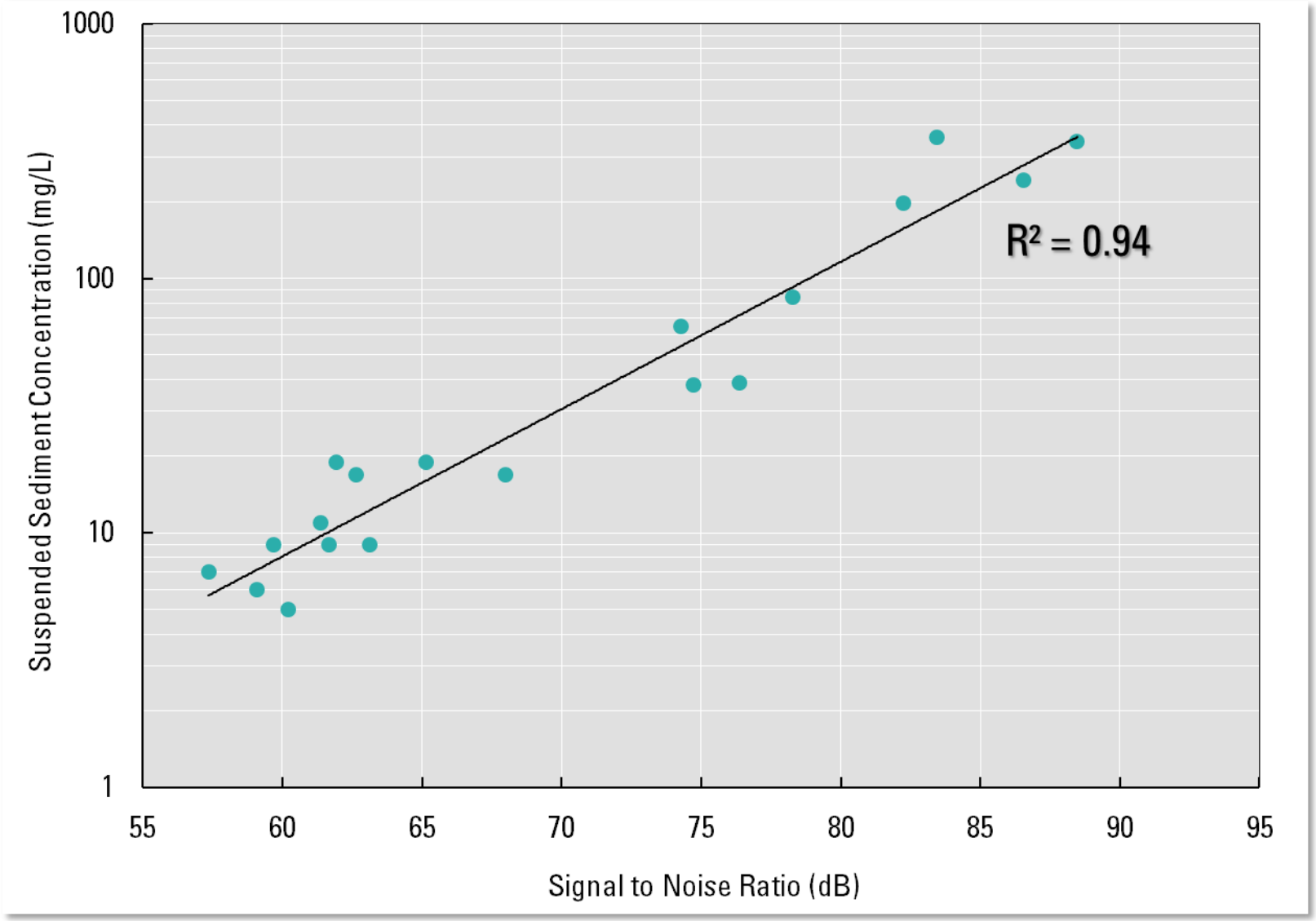
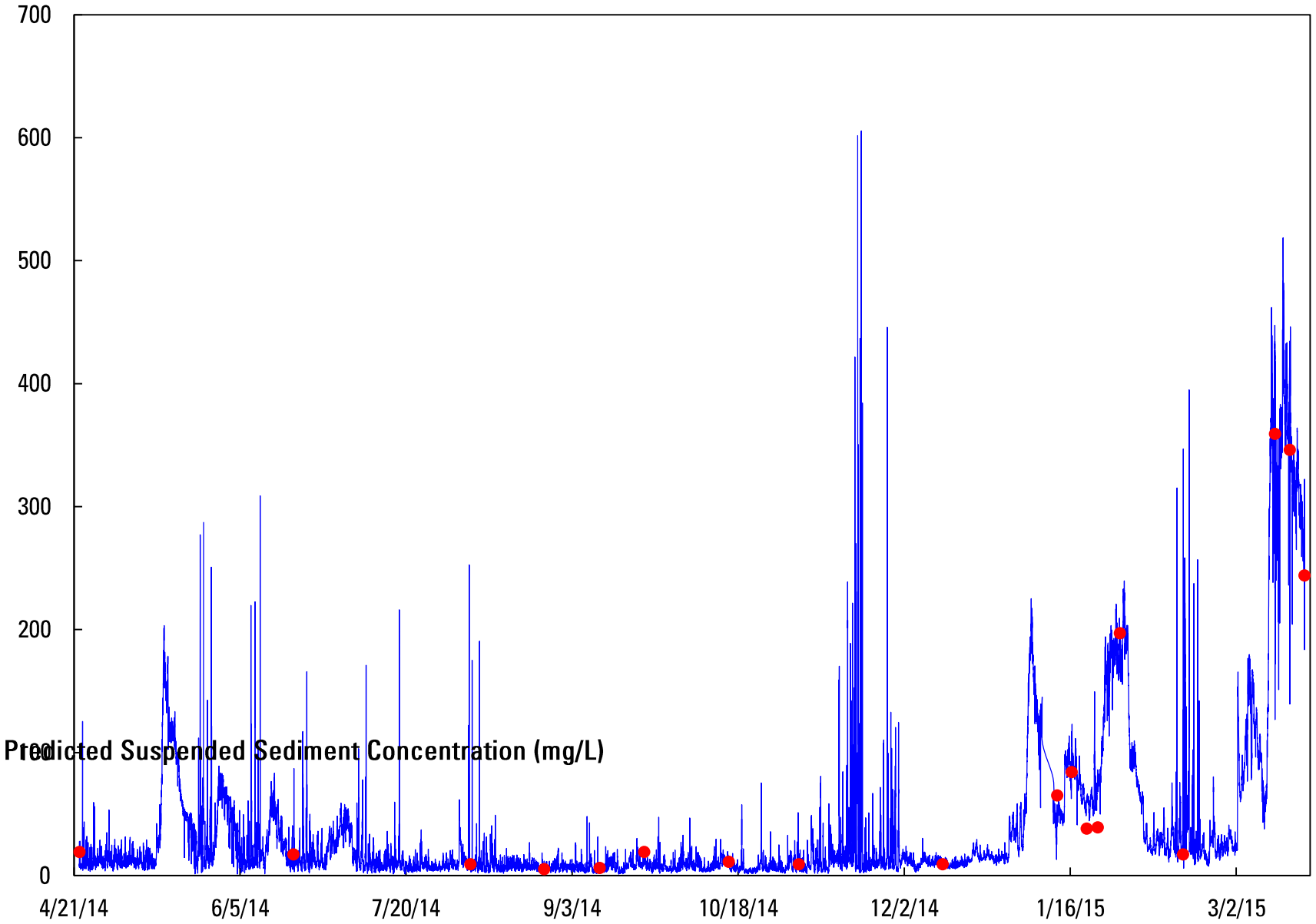
Trinity River



Discharge range: 9 – 20,100 cfs


700
600
500
400
300
200
100
0
Predicted Suspended Sediment Concentration (mg/L)
4/21/14
6/5/14
7/20/14
9/3/14
10/18/14
12/2/14
1/16/15
3/2/15

Colorado River

2012-2015

	N	Median	Min	Max
Ammonia (mg/L as N)	23	0.10	<0.01	0.32
Nitrate + Nitrite (mg/L as N)	23	0.863	0.088	4.27
Orthophosphate (mg/L as P)	23	0.162	0.06	0.378
Total Phosphorus (mg/L as P)	23	0.778	0.304	1.82
Total Nitrogen (mg/L)	23	2.38	0.72	5.53
Suspended Sediment (mg/L)	22	737	6	2230

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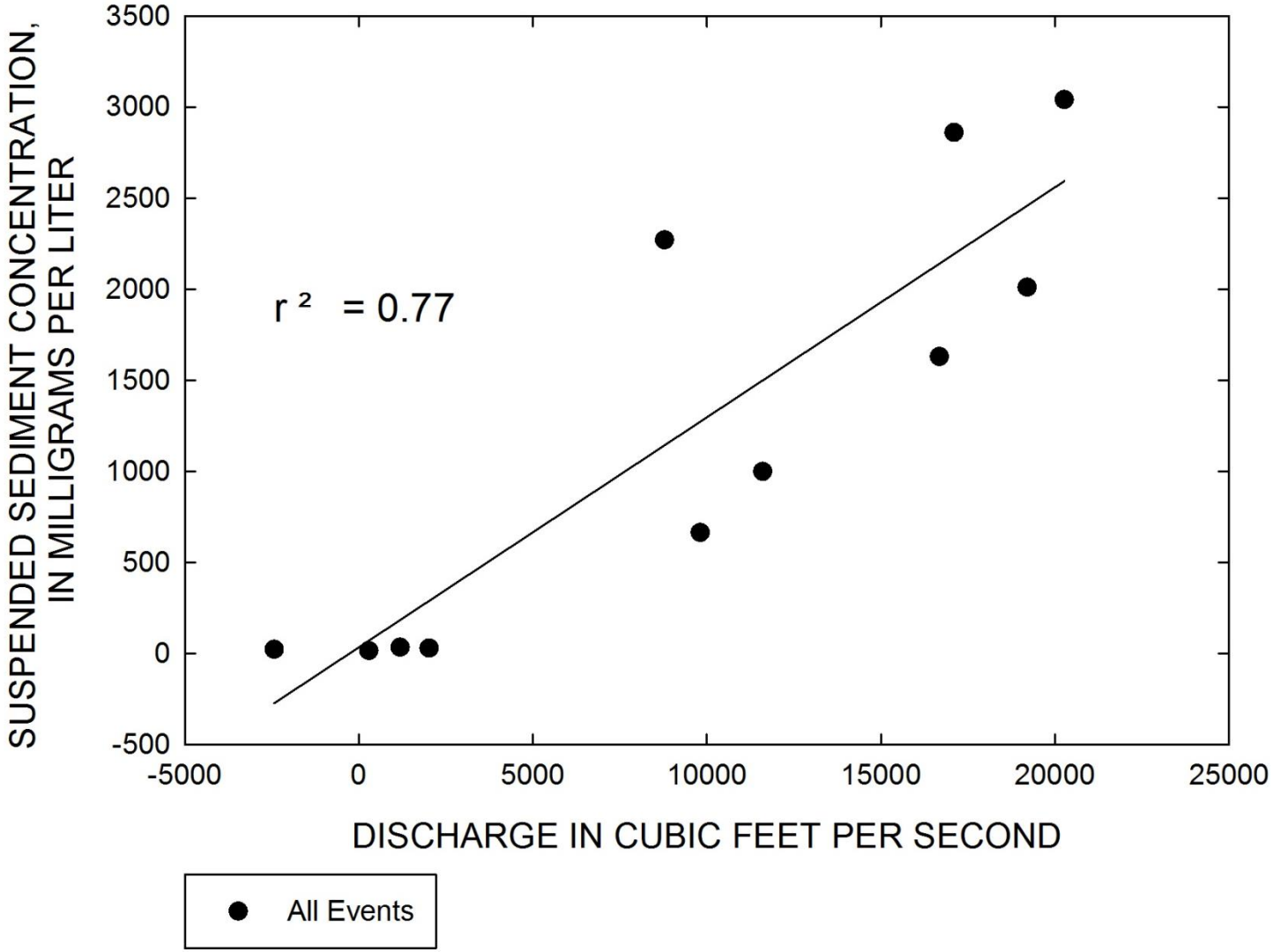
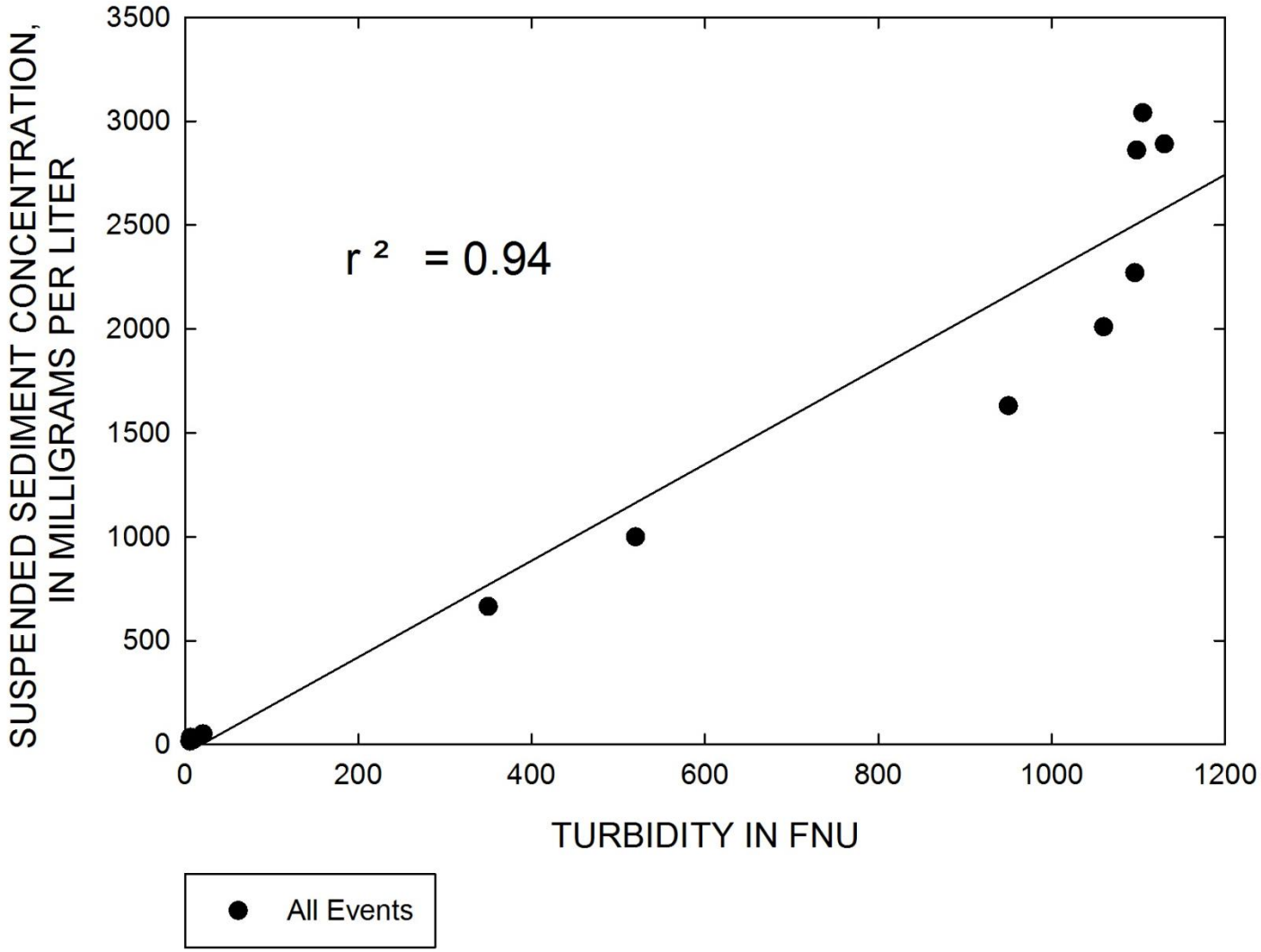

SUSPENDED SEDIMENT CONCENTRATION, IN MILLIGRAMS PER LITER
3500
3000
2500
2000
1500
1000
500
0
-500
r ² = 0.77
-5000
0
5000
10000
15000
20000
25000
DISCHARGE IN CUBIC FEET PER SECOND
All Events


SUSPENDED SEDIMENT CONCENTRATION, IN MILLIGRAMS PER LITER
3500
3000
2500
2000
1500
1000
500
0
r ² = 0.94
0
200
400
600
800
1000
1200
TURBIDITY IN FNU
All Events

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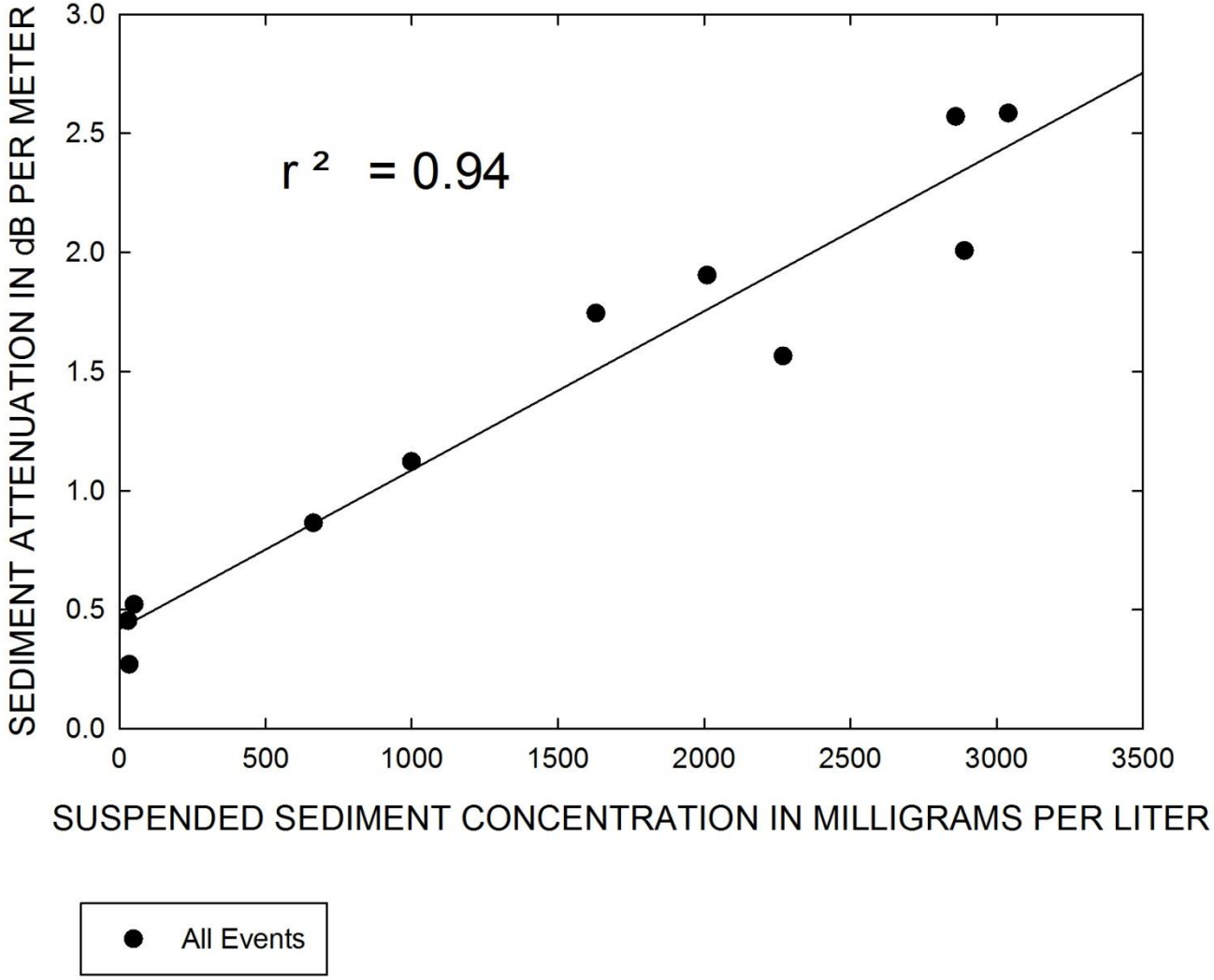
Trinity River

Colorado River


SEDIMENT ATTENUATION IN dB PER METER
3.0
2.5
2.0
1.5
1.0
0.5
0.0
r ² = 0.94
0
500
1000
1500
2000
2500
3000
3500
SUSPENDED SEDIMENT CONCENTRATION IN MILLIGRAMS PER LITER
All Events

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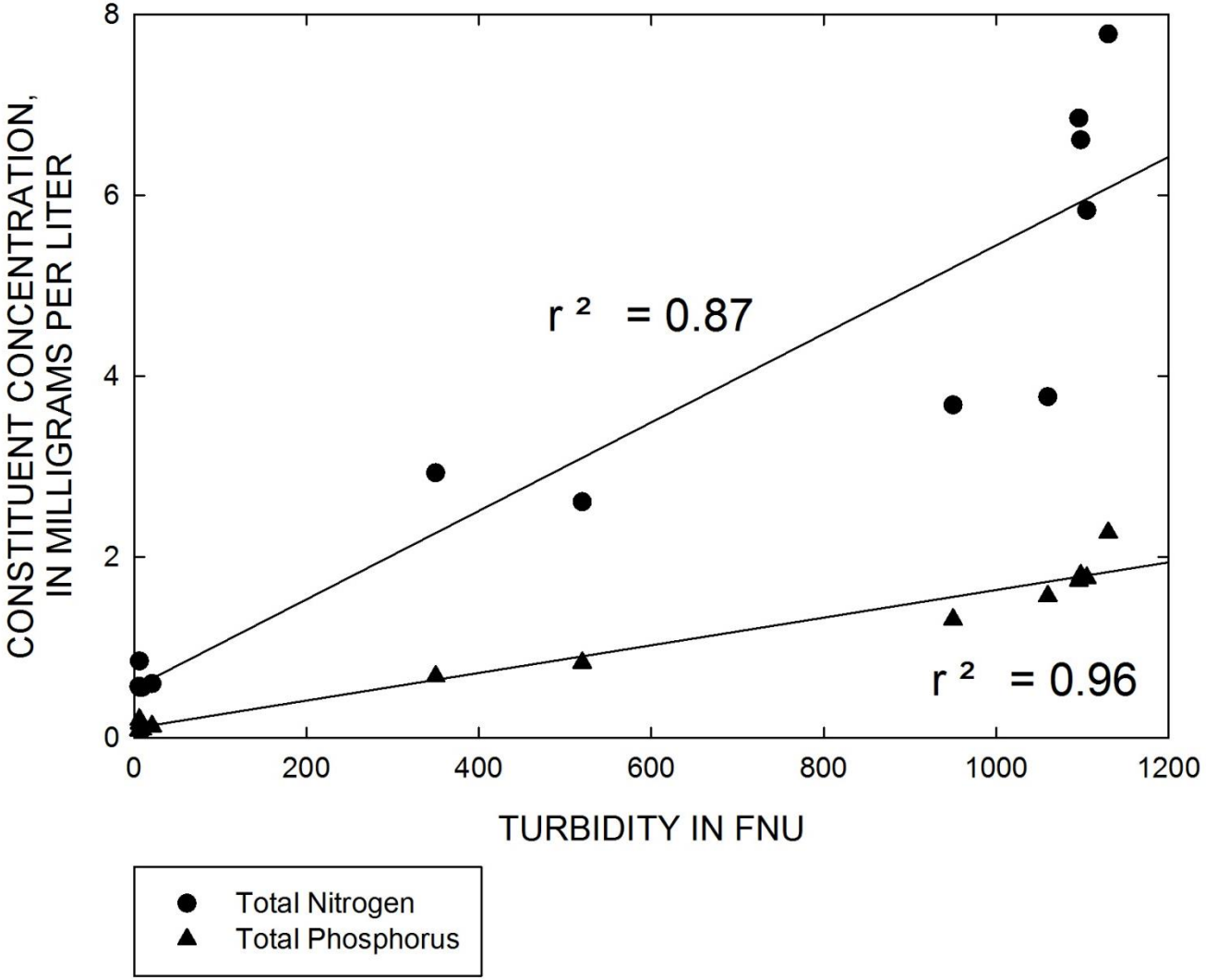
CONSTITUENT CONCENTRATION, IN MILLIGRAMS PER LITER
TURBIDITY IN FNU
r ² = 0.87
r ² = 0.96
0
2
4
6
8
0
200
400
600
800
1000
1200
Total Nitrogen
Total Phosphorus

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Questions

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